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ABSTRACT

The usage and availability of calculators, computers, and related instructional materials are presented. This publication is a Know-Pak, a summary of materials and articles that is part of a series of information packets developed by the Oregon Department of Education. Topics covered include: (1) a forecast of a computer literacy crisis in American education; (2) model goals for computer education; (3) sample program course and instructional goals; (4) computer use in Oregon; (5) computer and calculator terminology; (6) calculator use in elementary schools; (7) available textbooks; (8) sample problems; and (9) lists of current computer assisted instruction projects. Annotated bibliographies on articles from the "Oregon Computing Teacher," selected summarized reports from the Oregon Council for Computer Education, and other sources of information such as publications, organizations, and people active in Oregon's computer education programs are also included. (MP)

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KNOW - PAK

No. 17
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CALCULATORS AND COMPUTERS IN THE CLASSROOM

Select Summaries of Current
Education Topics

Center for Program Coordination
Oregon Department of Education
700 Pringle Parkway SE
Salem, Oregon 97310

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STATE OF OREGON
DEPARTMENT OF EDUCATION

SALEM, OREGON 97310

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This KNOW-PAK is one of a series offered by the Department of Education to help educators keep up with new ideas about important topics. Each packet contains summaries of articles on a topic of current interest to Oregon educators. Wherever possible, several points of view are presented.

In presenting this material, however, no particular method of operation or point of view is advocated. And while the development of this packet was supported in part with federal funds, the opinions expressed herein do not necessarily reflect the position or policy of any agency, and no official endorsement should be inferred.

It is hoped that this KNOW-PAK will be helpful to teachers, administrators, counselors, consultants, parents, and others concerned about what the schools should be doing in mathematics education.

We are very grateful to Dr. David Moursund and Phillip East of the University of Oregon, who supplied the basic material from which this KNOW-PAK was adapted. Readers who are interested in obtaining the original sixty-seven page document may contact Don Fineran at the Department of Education and he will forward a copy to the requester.

Comments about this KNOW-PAK and the series are welcome. For addition information, contact:

Dr. R. E. Myers
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700 Pringle Parkway SE
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REM:mtc

CALCULATORS AND COMPUTERS IN THE CLASSROOM

FORECASTING A CRISIS

In 1978, Andrew R. Molnar of the National Science Foundation issued a strong statement with important implications for future educational planning:

The information explosion in science and the shift in our economy from the production of industrial goods to a greater emphasis on science and knowledge-based industries has created a discontinuity in the nature of jobs and our educational needs. Ironically, widespread dissatisfaction with our schools has led to a nationwide, back-to-basics movement. Computers which have become indispensable to the operation of science, business, and government are not a major part of American education. While many schools have introduced computers into their curriculum, these local efforts only partially satisfy the country's needs at costs which are prohibitive and unnecessary when viewed nationally. In an information society, a computer literate populace is as important as energy is to an industrial society. Other nations have begun the task of restructuring their systems to include computers and unless we begin soon, the next crisis in American education will be the computer literacy crisis.

Are we really on the verge of a computer literacy "crisis"? There's no denying the increasing importance of computers--meaning both calculators and computers--to all facets of business, social science and physical science.

What About the Classroom?

This Know-Pak is meant to help you answer the question: How should calculators and computers be used in instruction? We'll suggest some answers and provide information on resources--including people--that can offer more details.

Two Views

Basically, there are two ways to think of computer instruction:

1. Teaching ABOUT Computers

Teaching computer literacy, computer programming and computer science.

2. USING Computers in Instruction

Using computerized information delivery to teach math, English or any discipline.

Remember . . .

Computer technology is not a subfield of math, but a large interdisciplinary field in its own right.

MODEL
GOALS

Instructional goals for computer technology can take countless forms. Leaders in the field recommend these three as a basic guide:

1. All students should become computer-literate. That is, they should have a working knowledge of a computer's general capabilities, limitations and potential applications.
2. Computers should be used as an instructional aid when such use is educationally and economically efficient.
3. Students with sufficient interest and academic potential should have access to advanced training in computer technology.

COURSE GOALS
IN
COMPUTER
EDUCATION

Over a period of years, the Clackamas County, Multnomah County and Washington County Educational Service Districts have worked together--on the Tri-County Goal Development Project--to produce course goals for their K-12 curricula. During 1978-79, Dick Ricketts directed a goal development project for computer education.

The Course Goals in Computer Education materials (estimated cost \$10) are soon to be available from

Commercial-Educational Distributing Services
P.O. Box 8723
Portland, Oregon 97208

These materials contain goals for planning and evaluating elementary and secondary curricula in

- o Computer literacy
- o Computer science
- o Computers and society
- o Data processing
- o Computer programming

The purpose of these materials is to help teachers decide WHAT should be learned. Teachers themselves decide HOW the material will be taught.

Format

The Course Goals materials contain program goals and course goals. At the classroom level, the teacher must further refine course goals into instructional goals that suit his or her curriculum, instructional style, and students' needs.

Example

Program Goal: The student knows principles, procedures and limitations of computer systems and can use computers as a tool for inquiry, problem solving and recreation.

Course Goal: The student knows the difference between system commands and program language statements.

SAMPLE*

Instructional

Goal: The student is able to identify LIST, RUN, SAVE and GET as system commands.

COMPUTER
USE IN
OREGON

Instructional use of computers is growing rapidly. In Oregon, over 75 percent of all secondary students are enrolled in schools that make some instructional use of computers. Between 5 and 10 percent of Oregon's elementary students have access to school computers.

Two
Delivery
Modes

There are two common methods for delivery of computer service:

1. A school or school system can join a consortium. METOOM (operating out of Multnomah ESD) and OTIS (operating out of Lane ESD) are the largest of these systems in Oregon. Each serves dozens of schools, many thousands of students. Timesharing and centralized administration make the consortium approach relatively economical.
2. A school can purchase a microcomputer. Machines in the \$500 to \$2000 range are now in use throughout Oregon at all educational levels. Their price is within the budget of most schools: their small size makes for easy portability.

Most microcomputers are programmable in BASIC; other languages, like FORTRAN and PASCAL, are becoming available. Information is conveyed via a TV screen--usually black and white. Music generators are available; so are hook-ups with scientific equipment.

COURSES

Teaching
About
Computers

In the early 70s, the Oregon Council for Computer Education recommended that computer literacy be a goal for pre-college education in Oregon. That goal has not yet been realized. A solid course in computer literacy would likely include some computer programming and a little more sophisticated computer science.

Courses in computer programming are fairly common in Oregon's secondary schools. A full-year course in computer science--

*Not part of the Course Goals materials.

akin to the high school physics or chemistry course--is not yet well established. Over the next decade, this is expected to become a standard offering.

Using Computers in Instruction

Instruction via computer can be simple drill--a sort of automated flashcard system--or it can involve the most sophisticated problem solving through programmed interactive tutoring and computerized simulation.

Computer assisted learning is most common today where education is expensive: special ed classes, medical school, military institutions. However, declining prices are bringing computers into regular classrooms--and homes, too.

THE TERMINOLOGY

Understanding how computers work demands sophisticated technological knowledge. But little technological knowledge is required to use computers. Mastering the vocabulary is a start.

"Computer": a comprehensive term

As used in this Know-Pak, the word computer covers the full range of electronic digital calculator and computer equipment:

Price Ranges

\$5	\$500	\$50,000	\$5 million and up
Pocket Calculator	Micro-Computer	Mini-Computer System	Very Large Computer System

The simplest pocket calculator has much in common with the most sophisticated computer. Each uses electronic circuitry to take in, store, manipulate and give out information.

Calculators

Calculators range in price from about \$5 to \$500. Very good quality "name brand" six-function machines with memory are available in the \$10-20 range. The functions are addition, subtraction, multiplication, division, square root, and percent. The best buy for elementary and junior high school students is generally considered to be a five- or six-function machine with four-key memory and liquid crystal display (LCD). Such a machine meets all of the calculational needs of pre-algebra level students, and a set of batteries will generally last for a year or more of intensive use.

More expensive calculators have many more functions and/or are programmable. The trigonometry and/or business functions on these machines are useful to some senior high students.

Computers

Computers differ from calculators in that they have a full alphabetic keyboard; computers can work with words as well as numbers. All computers have these features:

1. Input Units
Information may be fed into the computer via a typewriter-like keyboard, or more sophisticated equipment.
2. Output Units
The computer may give out information via TV screen, typewriter, printer, or more sophisticated equipment.
3. Memory
The computer memory stores instructions and data.

Primary memory is fast, but has limited capacity and is relatively expensive.

Secondary memory works more slowly, but has a very large capacity and is relatively inexpensive.
4. Central Processing Unit: (CPU)
The CPU can interpret and carry out detailed, step-by-step instructions at a high rate of speed.
5. Language(s)
Every computer is constructed to "understand" its own machine language; generally, each brand has a different language. Programs (software) can be written so that a computer "understands" a wide variety of languages: for example, BASIC, FORTRAN, PASCAL and COBOL.

Software

Software means programs--detailed step-by-step sets of directions written in a language understandable to a particular computer. A computer without software is useless. Nowadays the computer software needed to accomplish a particular task can well cost several times what the hardware does. Software is expensive but essential.

There are two general categories of software. Systems software is designed to help a user interact with a computer system. It includes language translators that transform computer languages such as BASIC, COBOL, FORTRAN, and PASCAL into the particular computer's machine language. Each translator is a large, sophisticated (expensive) program, and a different one is needed for each language a machine is to understand.

Applications software is designed to help solve specific problems. Thousands of programs are commercially available. But finding a program to solve a particular problem is often difficult. Because of differences between machines, languages, and dialects of languages, applications software is not easily interchangeable

or transportable between different brands/models of computers. This is a major problem.

In the Classroom

It is relatively simple to decide to buy an inexpensive calculator or even a classroom set. Calculators are easy to understand and use; no software is needed. But buying a computer is another matter. The range of hardware and software is immense. A few hours of study may provide enough background for purchasing a calculator. But it's a good idea to SEEK THE ADVICE OF SOMEONE KNOWLEDGEABLE AND EXPERIENCED before investing in a million-dollar computer system.

CALCULATORS IN ELEMENTARY SCHOOLS:

Numerous studies have been conducted on the use of calculators in elementary schools. These studies generally address such questions as the following:

Questions for Research

1. Will use of calculators increase students' knowledge or computational skill?
2. Will use of calculators affect student motivation?
3. Will students enjoy using calculators?

Findings

Based on a review of recent research, the following conclusions seem warranted:

1. There are no measurable detrimental effects resulting from use of calculators to teach math in grades 2 through 6.
2. Most children feel very positive--even excited--about using calculators.
3. Children generally learn to use calculators within 30 minutes of instruction, and can perform computations much more successfully than children not using calculators.

"I felt like I was cheating."

Some children feel guilty about using calculators. Teachers and parents who believe something must be "wrong" with quick, easy computation can reinforce these guilt feelings.

However, the data on student performance provide NO EVIDENCE to indicate that guilt associated with using computers is justified.

Implications for Further Study

Data on detrimental effects are not based on extensive (more than 14 weeks) or intensive (more than 40 percent) use of calculators. Followup studies should take these factors into account.

TEXTBOOKS:
A Growing
Resource

There are approximately as many calculators in use in the U.S. today as there are television sets.

Most homes now have one or more calculators, almost all places of business use them, and they're fairly common in schools.

The extent to which calculators are used in schools--even when available--varies widely. One reason could be the LACK OF QUALITY MATERIALS to guide computer instruction.

GOOD NEWS: The list of available resources is growing rapidly. Many math textbook series now include problems to be solved with calculators. Books containing such problems include--

Examples
of
Textbooks

1. Games, Tricks and Puzzles for a Hand Calculator by Wallace Judd.
2. Games With the Pocket Calculator by Sivasailam Thiagarajan and Harold Stolovitch.
3. Problem Solving With Calculators by Karen Billings and David Moursund.

These books contain a wide range of thought provoking exercises and word problems. Here's a sample from Wallace Judd:

TAXES IN TAXES???

Naturally, many people believe that rich people should pay more taxes than poor people, since the wealthier ones have more money. But sometimes this policy is carried to extremes. In one place I recently heard of, the tax rate was made the same as the number of thousands of dollars a person earns. For example, if a person earns \$6000, then his tax is 6% of that. But if a person earns \$92,000, then his taxes are a whopping 92% of that. What is the most you could have left after taxes, and how much would your income be to make that take-home pay? What income would leave you the most money after taxes?

(From Games, Tricks and Puzzles for a Hand Calculator by Wallace Judd.)

More Sample
Problems . . .

The following sample problems are from the Billings and Moursund book Problem Solving With Calculators (Chapters 4 and 7).

FORMULAS

Apples are four pounds for a dollar. What will one pound cost?

Procedure: Divide

$$\frac{\$1.00}{4} = 25 \text{ cents per pound}$$

Oranges are 29 cents per pound. How much will six pounds cost?

Procedure: Multiply

$$.29 \times 6 = \$1.74$$

Pat is paid \$17.50 at the end of each week for the part-time job she has. If she saves all of it, how long will it take her to save enough money for a 10-speed bicycle costing \$134.99?

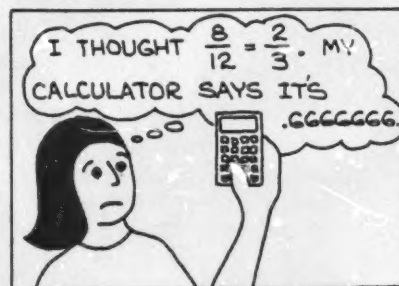
Bagels are \$2.08 per dozen, or 18 cents each. Orders of five dozen or more placed in advance receive a six percent discount. How much will 15 dozen bagels cost if ordered in advance? How much will 200 bagels cost if ordered in advance?

A store is giving a 15% discount off the list price of each item. Terry buys a table listed at \$87.40, two chairs listed at \$26.90 each, and three pillows listed at \$7.99 each. How much must Terry pay?



THE NUMBER LINE

By now you are aware that calculator arithmetic is not exactly the same as "real" arithmetic. The 8-digit accuracy, underflow, and overflow are examples of differences.



NUMBER LINE PROBLEMS

Start with 1.0 in your calculator display. Repeatedly divide it by 10 until an underflow occurs. (This happens when you unexpectedly get zero as an answer.) The result immediately before the underflow is the smallest positive number your calculator can display? What is it? What is the negative number closest to zero on your calculator?

Use your calculator to find each of the following calculator numbers:

- a) The smallest number > 1 . How much larger than 1. is it?
- b) The smallest number > 10 . How much larger than 10. is it?
- c) The smallest number > 100 . How much larger than 100. is it?

Complete the following sentences.

- a) In the range 1. to 10. inclusive, the number line for my calculator contains _____ points. They are equally spaced, with a difference of _____ between successive pairs of points.
- b) In the range 100. to 1000. inclusive, the number line for my calculator contains _____ points. They are equally spaced, with a difference of _____ between successive pairs of points.

Problem Solving
With
Calculators . . .

the book from which these sample problems were taken, is soon to be published by dilithium Press. The book, aimed at junior high students, has been field tested with a mixed group of seventh/ninth graders at Roosevelt Junior High School in Eugene.

Some
Data Entry
Problems

The following sample problems are taken from Karen Billings and David Moursund, Are you Computer Literate? Portland: dilithium Press, 1979.

- 1. A good key punch operator can punch about 15,000 characters per hour. If one punched card can contain 80 characters, how many full cards can a good key punch operator punch per 8 hour day? Roughly how long would it take such a person to key punch a million character book? (That is the length of a full length novel.)
- 2. A particular optical character recognition machine can read one typewritten page in four seconds. Suppose that a typical page contains 40 lines of typing, and an average line is 60 characters long. Express the speed of this OCR in characters per second. How long would it take this machine to read a million characters?

3. Each year in the United States about 30 billion checks are written and cashed. The amount of each check is keyed into the check in magnetic ink, by a data entry person. Then a second person checks for errors by keying the data on a verifier. A verifier is a machine that compares what is being keyed with what was printed on the check by the first data entry person. Suppose that one person can key in the data from 6000 checks in one working day. Remember that this means it takes two people to actually do the data entry on 6000 checks in one day. Estimate the number of people who make their living keying in bank check data in the United States.

**If Your
School
Planning to
Purchase a
Calculator?**

Following are a few suggestions for junior high schools contemplating purchase of a calculator:

1. Purchase an LCD (liquid crystal display) rather than an LED (light emitting diode) calculator. This virtually eliminates the problem of batteries wearing out.
2. Purchase a calculator with a simple memory system. The calculator memory system sometimes recommended is the four-key memory system with M+, M-, CM and RM keys.
3. Purchase a calculator that uses algebraic logic. Such a calculator has an = key and does not have an ENT key. (An ENT key is essential to a "Reverse Polish Notation" calculator, often used in more advanced science and engineering work.)
4. Purchase a calculator that has only a limited number of function keys beside the +, -, x and $\div$. A square root key is not essential.
5. Purchase a calculator that does not use scientific notation and that is not programmable.

RESOURCES

**COLLEGES AND
UNIVERSITIES**

Oregon has an excellent history of inservice and preservice teacher training in computer education. Are you interested in a course for yourself or a district group? Begin by contacting a nearby college or university. Most can offer some help.

The most comprehensive local program is offered through the University of Oregon. They offer a master's degree and doctorate in computer science education. For details, contact

The Department of Computer Science
University of Oregon
Eugene, Oregon 97403

COURSEWARE

Large Probably the best known computer assisted instruction projects are PLATO, TIOCIT and the work of Pat Suppes.

PLATO PLATO was developed at the University of Illinois with funding from the National Science Foundation and the State of Illinois. "A Personal Evaluation of the PLATO System" was published in SIGCUE (Special Interest Group on Computer Uses in Education) Bulletin, April 1978, and reprinted in the Oregon Computing Teacher, Vol. 6, No. 1.

PLATO received mixed reviews--with the positive, however, heavily outweighing the negative.

TIOCIT The TIOCIT system was developed at Brigham Young University in conjunction with the Mitre Corporation. "TIOCIT Update" by Curt Torgerson appears in Vol. 4, No. 3 of the Oregon Computing Teacher. It is not as lengthy or detailed as the PLATO evaluation, but does express the same guarded optimism. TIOCIT makes use of modified color TV sets as terminals, and runs off microcomputers. Thus it is considerably less expensive than PLATO.

Both PLATO and TIOCIT have been exhaustively evaluated by Educational Testing Service (ETS) of Princeton, New Jersey. For further information, check these sources:

1. Alderman, Donald L. Evaluation of the TIOCIT Computer Assisted Instructional System in the Community College. Princeton: Educational Testing Service, 1978.
2. Lidtke, Doris. "Can Computer Aided Instruction Profit from the Developments in Artificial Intelligence?" OCT, Vol. 6, No. 3.
3. Murphy, R.T. and Apple, L.R. Evaluation of the PLATO IV Computer Based Education System in the Community College. Princeton: Educational Testing Service, 1977.

. . . . and
Small

Patrick Suppes is well known for developing an extensive amount of CAI material for use at the grade school level. During the 60s

he developed drill and practice materials for use in math and language arts. These materials are still widely used. In developing these materials Suppes analyzed about a dozen elementary school math textbook series, then performed a frequency count on types of problems that appeared. The math drill and practice materials are designed to provide a typical student, grades 1 through 6, a ten-minute daily drill. This amount of practice is comparable, thanks to the frequency count, to performing the original exercises contained in the textbook.

More
Small
Programs
Available

With the advent of smaller, less expensive computers, more single lessons or programs are being written. Some are ready for teacher use, others poorly documented with little or no additional courseware.

The Huntington II modules are well done and provide student and teacher materials to be used with the programs. These programs are widely distributed (OTIS and most universities have them) and the teacher materials are available from Digital Equipment Corporation.

Help in
Selection

Microcomputers are becoming more common too. The major problem here lies in deciding what's good. Centers to assist with evaluation and selection will eventually exist. For help locally, contact

Judy Edwards
Northwest Regional Educational Laboratory
710 SW Second Avenue
Portland, Oregon 97204

You Can
Join
OCCE

One way to obtain current information on computer education is to join the Oregon Council for Computer Education (OCCE). The goals of the Council are

1. To participate in the statewide coordination of activities relating to the instructional use of computers in Oregon.
2. To give all Oregon students equal opportunity to enjoy the potential benefits of instruction by computer.
3. To provide curriculum guidelines and standards for the instructional use of computers.
4. To recommend programs and standards for the training of those involved in computer-related instruction.
5. To encourage the establishment of effective mechanisms for sharing and disseminating information on computer related instruction.

6. To promote sound developmental directions for computer related education through program evaluation.

To join . . .

Dues for 1979-80 are \$8. To join, send your name, home and school addresses, and phone number along with your dues to

Howard Bailey
Computing Center
Eastern Oregon State College
LaGrande, Oregon 97850

Publication:
OCT

OCCE publishes a "semiperiodical," the Oregon Computing Teacher (OCT). On the following pages a number of past OCT articles are annotated to give the reader a feeling for the "flavor" of the publication. These reprints may be purchased by writing to Howard Bailey at the address shown above.

OCT
ARTICLES:
An
Annotated
Bibliography

1. Shirey, John. "Using the Computer at Churchill High School," OCT 5, 3, June 1978.

John Shirey uses a program called CVAREA (available on OTIS) to illustrate the accuracy of various methods of determining area under a curve. Output from the program is used as a springboard to discuss the different methods in more detail.

2. Rogers, Jean. "Introducing Calculators to Elementary School Students," OCT 5, 2, April 1978.

Jean Rogers gives a step-by-step procedure for introducing calculators for the first time to elementary students. Essentially everything but the calculators and the students is provided in this article.

3. Allee, John G., et al. "An Elementary School Language Arts CAI Series," OCT 6, 3, February 1979.

John G. Allee (et al.) have developed two volumes of CAI sessions that "primarily explore verb-pronoun relationships that often reflect written usage problems." Outputs from several programs are included.

4. Thorsett, Grant O. "Application of the Computer in an Introductory Biology Laboratory," OCT 4, 3, May 1977.

This article presents use of the computer at the college level but may have merit for high school use too. Thorsett discusses several programs used in biology lab sessions. The primary goals of these programs are to introduce the topic of genetics and to stimulate results of gene pool manipulation.

5. Billings, Karen. "Computer Use at Roosevelt Junior High School, OCT 3, 3, April 1976.

Karen Billings gives an overview of the uses made of a computer terminal (hooked to OTIS) at Roosevelt Junior High School in Eugene. Specific programs used (other than CIS) are not given. Billings presents a fairly detailed outline of a nine-week computer literacy course.

6. Garrett, Keith. "You Get Students Turned On and Then What?" OCT 2, 2, June 1975.

This article emphasizes methods for keeping students motivated while at the same time showing them the "real world."

7. Bates, McClellan and Tower. "Using My Friend the Computer with Upper Elementary and Junior High Students," OCT 5, 2, April 1978.

Nancy McClellan explains how she used this book by Jean Rice as her main resource with fourth and fifth graders to increase their computer literacy level. Having no access to a computer facility, she depended primarily on this book and two films, The Computer (for grades 2 through 6) and Computers (for grades 4 through 9) to impart some basic concepts.

Some points of emphasis: the importance of stressing to young children that computers do not think, that they are programmed by people to do the things they can do; including in instruction the parts of the computer and the function of each, simple computer vocabulary, info on computer hardware and software and flowcharting.

Sara Jane Bates, a junior high math teacher, worked with students who had no previous experience with computers. Her class consisted of about 22 ninth graders and met daily in 45-minute sessions for three weeks. Since she would have access to a computer facility, Ms. Bates' plans for the class included hands-on activities with a terminal. Goals were (1) to acquaint the students with the computer, (2) to help students become computer literate, and (3) to provide experience with the computer. The book My Friend the Computer and accompanying teacher's guide and activity book were used as primary resources.

Bob Tower, a high school English teacher, explains how he works with a class of 21 seventh graders, having access to a computer terminal. His plans include having students write to different computer companies asking for information

Annotated
Bibliography,
cont.

and materials, and a field trip to the university computer center. Mr. Tower comments on the enthusiastic involvement of the students who use the computer after class to write their own programs for solving math problems.

8. Molnar, Andrew R. "The Next Great Crisis in American Education," OCT 6, 1, September 1978.

Molnar contrasts the state of our information-oriented society with the notable absence of computer instruction from educational programs nationwide. As our careers and our very way of life grow increasingly dependent on computer technology, Molnar predicts a "computer crisis."

9. Elliott, Reid. "Computers and Privacy: What Can Be Done?" OCT 6, 2, December 1978.

Reid Elliott, a high school student in Advanced Computer Programming, submitted this paper to his teacher as part of the course requirements. Reid does a very good job of pointing out the possible failures in our current methods of overseeing the use of data banks. An all too possible scenario of events is presented and Reid offers ideas on avoiding these events.

10. Moursund, David. "Calculator and Computer Education for Elementary School Teacher Certification," OCT 5, 1, October 1977.

Moursund presents his ideas on elementary teacher education and certification. In particular, he stresses the importance of thorough study of calculators and computers if elementary teachers are to be prepared to meet the challenge of the computer's mounting influence on everyday life and, hence, education.

11. Dempster, David. "When NOT to Use Calculators," OCT 3, 3, April 1976.

Dempster advises against using calculators to teach "basic computational skills" and discusses some precautions for using calculators. Many relate to basic skills.

12. Dunlap, Mike. "Computer Science in High School: A Course Outline." OCT, 1, 1, May 1974.

Dunlap presents a different concept of a high school computer science course in that programming and theory are de-emphasized. Following is Dunlap's overview of the course:

This course is designed to provide the student with a basic introduction to computer science. It considers the history of computers, a simplified look at computer programming, problem solving, problem

Annotated
Bibliography,
cont.

logic with flowcharting, concepts of computer systems and architecture, survey of available computer languages, simple computer math, elementary computer electronics, applications of the computer, the computer industry, and the future of computers.

13. Landauer, Edwin G. "Computer History," OCT 4, 1, October 1976.

Landauer presents a short history of computing mechanisms from the abacus to the modern computer. Though brief, this article is a good survey of computer history and can serve as a good base of study for a unit in a computer literacy course.

14. Bregar, William S. "Artificial Intelligence in the Classroom: Part I," OCT 4, 3, May 1977.

This article is the first in a two-part series which provides a basis for understanding Artificial Intelligence and its application to computer assisted instruction. This article focuses on knowledge representation and natural language understanding.

15. Wright, Edward B. "Use of PLATO in Teaching Basic Mathematics," OCT 5, 1, October 1977.

Wright's article serves three purposes. First, it provides a brief overview of the Heimer Mathematics Program, which is based on four "conditions of adequacy" for a "personalized system of instruction" and further on 12 "instructional propositions." Wright discusses how the courseware was created and presents the model used in implementing the program. Second, it summarizes results of an experiment in which this program was implemented. Third, it includes some evaluative comments about PLATO.

16. Jensen, Kenneth. "A Novice's Guide to Computers in Secondary Schools," OCT 6, 1, September 1978.

This paper is intended for the teacher or school administrator with little or no previous computer experience. It provides an overview of some educational uses of computers, and discusses key ideas of hardware and software. Finally, it focuses on the issue of microcomputers versus time-shared terminals for use at the author's school.

Annotated
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cont.

17. Jongejan, Tony and Jerry Johnson. "Selection of a Computer System: A Dilemma for Educators," OCT 6, 2, December 1978.

This article is a report on a conference held in May 1978 and entitled "Computer Equipment for Mathematics Education: Which Way to Go?" The conference was attended by math educators and computer vendors. At the conference, the educators set minimum requirements for equipment, then presented questions to the vendors. From the vendors' responses, a comparison chart of different systems was prepared. The requirements, questions to vendors, responses and a comparison chart are all presented in the article.

SPECIAL
REPORTS
From
OCCE

OCCE publishes special reports in response to requests or as new information becomes available. Several are summarized here.

1. Computers and Computer Literacy in the Algebra I and the Trigonometry Classroom

Computer
Literacy
in the
Classroom

This document concerns computer literacy as it relates to the subjects a student takes in high school. For example, a student who studies higher level math should acquire complementary knowledge and skill in math-oriented computer literacy.

The first section of the document, "Integrating Computer Literacy With Existing Classes," deals with teaching computer literacy through existing courses and offers suggestions for integrating computer literacy activities into a high school Algebra I course.

The second section, "Guide to Computer Augmented Trigonometry," suggests ways of using computers to enhance content in a traditional trigonometry course.

2. Recommendations for Implementing Computer Literacy in Oregon Secondary Schools

Recommendations
Statewide

This report presents reasons for having a computer literacy program and summarizes the status of computer education programs in Oregon. It outlines a process for defining and assessing computer literacy, and offers recommendations regarding curriculum development and teacher training. Appendices include a rating scale for defining computer literacy, sample teacher training programs, and reprints of documents covering computer careers.

**Indexing
Schemes**

3. Information Retrieval

This special report does not provide a comprehensive overview of information retrieval--but it's a start. It features a discussion of automatic indexing schemes (of which Key Word in Context--KWIC--is the most common), a thorough review of Computer Output Microfilm (COM), and an introduction to Computer Input Microfilm (CIM).

**For the
Elementary
Teacher**

4. Computers in the Elementary School: A Course for Teachers

This report comprises two papers. The first, "Computers and Computational Aids: A First Course for Elementary School Teachers," is a detailed outline for a course designed to introduce elementary teachers to computers and electronic calculators. The second, an annotated bibliography on "The Instructional Use of Computers with Elementary and Preschool Children," offers insight into the range of literature covering the use of computers at the elementary level.

**FURTHER
SOURCES OF
INFORMATION**

What's the best way to obtain further information about computer technology? Here are three possibilities:

- o Publications
- o Organizations
- o People

PUBLICATIONS

1. The Arithmetic Teacher

Published eight times a year by

National Council of Teachers of Mathematics
1201 Sixteenth St. NW
Washington, D.C. 20036

Generally has an article or two on calculator use suitable for elementary or junior high arithmetic students.

2. Creative Computing

Published monthly by

Creative Computing
P.O. Box 789-M
Morristown, NJ 07960

Publications,
cont.

A magazine designed for a wide variety of computer users. Topics include

- o Program summaries and listings
- o Hardware evaluations
- o Programming hints
- o Special sections on PET, TR5-80, APPLE computers
- o Reports/opinions on various topics and uses of computers

Most issues have articles specifically related to education and many articles contain ideas useful to computer using educators.

3. The Illinois Series on Educational Application of Computers

A series of papers published by the

Department of Secondary Education
College of Education
University of Illinois at Urbana-Champaign
Urbana, IL 61801

4. The Mathematics Teacher

Published monthly September through May by

The National Council of Teachers of Mathematics
1906 Association Drive
Reston, Virginia 22091

Frequently contains articles/activities on calculator or computer use in the high school curriculum.

5. The Oregon Computing Teacher

(Name changed to The Computing Teacher)

A combination magazine, newsletter and professional journal. Probably the best source of computers in education information over a wide variety of topics.

6. Personal Computing

Published monthly by

Benwill Publishing Company
1050 Commonwealth Avenue
Boston, MA 02215

A magazine specifically oriented toward users of

Publications,
cont.

microcomputers. Articles cover a wide range of topics; many cover specific uses or programs. Issues frequently contain articles related to educational uses of computers.

7. T.H.E. Journal (Technological Horizons in Education)

Published six times yearly by

Information Synergy, Inc.
P.O. Box 992
Acton, MA 01720

Articles discuss the use of various technologies (computer, video systems, etc.) in education. Directed to administrators as well as instructors.

For the
Sophisticated
Reader

8. Readers with a good technical background in computer science will be interested in the publications of the Association for Computing Machinery and the publications of the Institute for Electrical and Electronics Engineering.

General
Audience

9. Recommended general audience publications include the following:

- o Computer Music
- o Dr. Dobb's Journal of Computer Calisthenics & Orthodontia
- o Interface Age
- o Kilobaud
- o Recreational Computing
- o Small Business Computers Magazine

Two
Bibliographies

10. Books

For a current list of relevant books, contact

Catlin Gabel School
8825 SW Barnes Road
Portland, Oregon 97225

Films

"Computers and Computer Applications," a film bibliography prepared in 1977 by Doris Lidtke and published as an OCCE Special Report, is available for \$3 per copy plus \$1 postage/handling per order. Over 400 titles are listed with pertinent information.

Organizations

1. The Calculator Information Center

The Calculator Information Center was established by the National Institute of Education at the ERIC Center.

Organizations,
cont.

for Science, Mathematics and Education. The purpose of the Center is to collect information about the uses of calculators in elementary and secondary schools and to provide consumers with information.

You Can
Help

To help establish the Center's information base, you can send information on

- o Instructional applications
- o The effect of using calculators

Materials will not be entered into ERIC without specific permission.

You Can
Get Help
Too

From the Center you can obtain

- o Annotated bibliographies
 - of curricular and instructional applications
 - with background information pertinent to educators
 - on research
- o Information bulletins on such topics as
 - available commercial instructional materials
 - available noncommercial instructional materials
 - schools in which calculators are used
 - characteristics of various calculators
 - selecting a calculator
 - designing school-based studies

If you have information to share, or if you wish to learn what others are doing with calculators, contact

M.N. Suydam, Director
Calculator Information Center
1200 Chambers Road
Columbus, Ohio 43212
(614) 422-8509

2. MECC (Minnesota Educational Computing Consortium)

Minnesota:
A Leader in
Computer
Education,
Precollege
Level

Thanks to support from the state legislature, Minnesota has become a (perhaps the) leading state in the use of computers at the precollege level. The consortium is statewide and financed by the state. Information is provided through a bimonthly newsletter that includes general reports of some computing activities in Minnesota. The newsletter is free; simply write to

MECC
2520 Broadway Drive
Highway 280 at Broadway
St. Paul, Minnesota 55113

Organizations,
cont.

3. ACM Elementary and Secondary Schools Subcommittee

The Association for Computing Machinery (ACM) is a professional computer society with over 40,000 members. The ACM organization includes an Education Board concerned with education at all levels. The Elementary and Secondary Schools Subcommittee is concerned with all aspects of instructional use of computers at the precollege level, as well as teacher preparation. Chairman of this subcommittee is David Moursund.

To get on the Subcommittee mailing list, contact

David Moursund, Chairman
ACM Elementary & Secondary Schools Subcommittee
Department of Computer Science
University of Oregon
Eugene, Oregon 97403

For information about joining ACM, write

Association for Computing Machinery
P.O. Box 12105
Church Street Station
New York, NY 10249

People

People are
good resources,
too!

Oregon is fortunate in having a large number of well qualified computer education resource people--only some of whom are listed here. This representative group includes many of Oregon's most active leaders in computer education. For the readers' convenience, an effort has been made to provide widespread geographical representation.

Howard Bailey
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Westfir, Oregon 97492

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Salem, Oregon 97301

Philip East
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Eugene, Oregon 97403

Judy Edwards
Northwest Regional Ed. Lab
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People,
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Portland, Oregon 97219

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Oakridge High School
Oakridge, Oregon 97463

Ron Tenison
Catlin Gabel School
8825 S.W. Barnes Road
Portland, Oregon 97225

Wally Waldman
Blue Mountain Community College
Box 100
Pendleton, Oregon 98701

Before we
close . . .

Are You
Computer
Literate???

A 1972 report of the Conference Board of the Mathematical Sciences recommended that computer literacy instruction be incorporated into our nation's junior high schools. Since then, many other organizations and individuals have voiced similar recommendations.

All the same, progress is slow. Lack of adequate computer hardware and software, lack of teachers with appropriate knowledge, lack of suitable textbooks--all contribute to the problem.

To help remedy the situation, Karen Billings, a junior high teacher, and David Moursund, a professor in computer science, wrote Are You Computer Literate? (Portland: dilithium Press, 1979--referenced earlier). The following quiz is excerpted from the Computer Literacy Exam at the end of the book. Try the quiz yourself--

see how "computer literate" you are. Good luck!!

1. What is computer literacy?
 - a. The ability to write computer programs.
 - b. Knowing what a computer can and cannot do, how computers are used, and how they may change our lives.
 - c. Knowing computer-related vocabulary, so you can read, write, and talk about computers.
 - d. Understanding how to build a computer.
2. A good way to think about computers is:
 - a. It is impossible for a computer to tell a lie.
 - b. Computers are built and programmed by people and these people should be responsible for what computers do.
 - c. Anything a human can do a computer can do better.
 - d. Any problem that can be solved by a computer should be since a computer cannot make a mistake.
3. A good definition of a computer is:
 - a. An electronic automatic device that can solve problems involving words and numbers.
 - b. A superspeed pocket calculator.
 - c. A machine that uses binary numbers to do math problems.
 - d. Any machine that can add, subtract, multiply and divide.
4. When we say a computer "understands" an instruction, we mean:
 - a. The computer can execute (carry out) that instruction.
 - b. The computer can explain the meaning of the instruction.
 - c. The computer's keyboard has a key corresponding to the instruction.
 - d. The computer can print out a definition of the instruction.
5. Most errors blamed on computers used in business are actually due to:
 - a. Hardware problems.
 - b. Programming errors.
 - c. Data preparation and entry errors.
 - d. None of the above.
6. A computer program for a mathematical model is called:
 - a. A computer simulation.
 - b. Artificial intelligence.
 - c. A large-scale integrated circuit.
 - d. Computer graphics.

WE HOPE THIS KNOW-PAK HAS BEEN A USEFUL RESOURCE FOR YOU!!